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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:	WO 90/05502
A61F 5/02	A1	(43) International Publication Date:	31 May 1990 (31.05.90)

(21) International Application Number: PCT/US89/05103

(22) International Filing Date: 16 November 1989 (16.11.89)

(30) Priority data:
275,789 23 November 1988 (23.11.88) US

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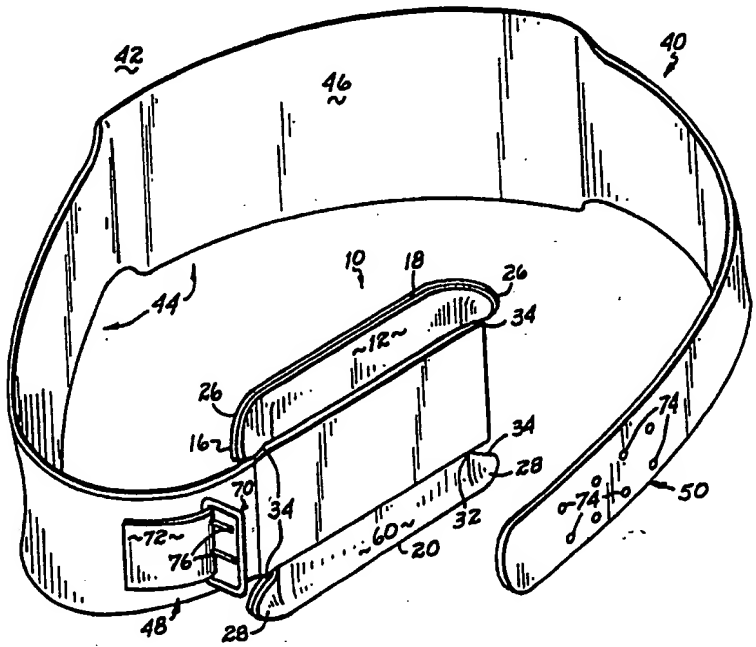
(81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent), DK, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: RIGID ABDOMINAL PAD FOR LUMBAR/SACRAL SUPPORT



(57) Abstract

A rigid abdominal pad (10) is disclosed as an accessory for a conventional weight lifters belt (40) or the like and which when held against the abdomen (82) to provide a bearing surface therefor reduces the risk of back or spinal injury arising from lifting heavy objects.

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RIGID ABDOMINAL PAD FOR LUMBAR/SACRAL SUPPORT

Background of the Invention

I. Field of the Invention

The present invention relates to a rigid abdominal pad for a lumbar/sacral support to decrease the risk of back or spinal injury arising from lifting heavy objects, for example.

II. Description of the Prior Art

Musculoskeletal disorders are some of the more common impairments in both male and female populations. Disorders of the back and spine make up the largest fraction of the total category of musculoskeletal problems. These conditions also rank first in cost outlays by industry. As a result, musculoskeletal disorders are among the most important disease categories affecting both industrial economies and various United States health reimbursement systems.

Indeed, low back pain is often believed to be one of the most common causes of absence from work in today's work force. It has also been estimated

that about 20% of all occupational injuries in the United States are back related and that about 70-80% of the world's population will have suffered this type of orthopedic problem sometime during their life.

Additional difficulties arise when the related cost of back problems occur. Taking into account the average hospital cost, salary compensation, disability payments and replacement expenses, the back ache poses itself as a destructive pathology in the American workplace. It has been estimated that such costs may be as high as $30 billion annually.

The etiology of back injuries are directly related to muscular-skeletal disuse and misuse syndromes, as well as the incidence of unpreventable trauma. Chronic stress and strain demonstrated over a period of years account for many degenerative related back pathologies. The results of general muscular-skeletal disuse and misuse manifest the eventual disruption of the vertebral bodies resulting in micro-fractures, herniation, and disk degeneration.

Certain of the risks of lower back pain and/or injury may be minimized by selecting appropriate individuals to perform the task. It is also desirable to provide education and training in the proper methods of lifting. However, these approaches are not widespread or properly followed in many

instances and thus do not add much to the prevention of industrial back injuries.

A more promising approach to reducing the risk of lower back injuries has come from the recognition that the human trunk or torso functions similarly to a resilient cylinder which can be made to stiffen or relax. As the cylinder stiffens, the stress on any given portion of the cylinder tends to spread out over the whole of the cylinder thereby reducing the stress at the given location. This situation similarly occurs in the human body, whereby as the intra-abdominal pressure (IAP) of the torso increases, the load on the human trunk is transferred from the back to the abdominal cavity. Specifically, (1) the spine is essentially a segmented column supported by the paraspinal musculature which attaches anteriorly to both the thoracic and abdominal cavities; (2) actions of the muscles through movement creates a rigid mass with the capability of transferring forces from the spine to the trunk; (3) contraction of the trunk musculature creates a system of pressurized rigid chambers in the thorax and abdominal cavities which are filled with air and a semi-fluid mass, respectively; and (4) IAP increases with the strain of muscle contraction.

It has been known to artificially induce some increase in IAP by compressing the abdomen with a

belt or corset tightened about the waist. An example is the well-known weight-lifters belt which is generally comprised of a leather strap with a widened portion adapted to be situated over the wearer's back and across the spine. Another device promoted widely for industry is known as the CompVest back support available from Comp Equipment Corporation, 1473 Energy Park Drive, St. Paul, MN 55108. The CompVest device is made of a light weight nylon mesh with anterior velcro closures and has a front portion adapted to be situated between the ribs and the pelvic bone and a rear portion adapted to overlie the back and spine and the upper buttocks.

With the conventional weight lifters belt or the CompVest device, tightening of the device about the waist has been suggested to increase IAP thus shifting some of the load from the spine to the abdominal cavity. However, even with the increase in IAP induced by compressing the waist, the stresses associated with lifting even normally encountered loads is believed to require more support than is provided by the belt or vest device. Specifically, it is believed that the spine and the trunk musculature must still bear an inordinate load thereby not sufficiently reducing risk of lower back pain and/or injury during normal lifting procedures. Similarly, the

musculature is thus strained and may fatigue or become injured.

Some belts or corsets have also been utilized to force proper posture for lifting. For example, a conventional weight lifters belt does not generally promote proper lifting posture. Welsh U.S. Patent No. 4,543,370 proposes to modify such a belt by equipping it with a wide front portion which contacts or overlies the sternal half of the tenth rib and the anterior portion of the iliac crest in the pelvis. The wide front portion acts to restrict excessive forward bending and thus promotes proper lifting posture. While forcing the abdomen to remain substantially straight, the approach suggested by Welsh to accomplish this result is not believed to be desirable. Contact by the front of the belt with the bony prominences about the abdomen is generally uncomfortable and may cause injury or lead users to stop wearing the belt. Further, that contact may lead to loss of consistent pressure distribution within the abdominal cavity. Such contact also limits the extent to which the front of the belt may be tightened against the abdomen. Hence, to promote proper posture as suggested in the Welsh patent may reduce the benefit available with a conventional weight lifters belt. For example, to obtain desired increases in IAP may require that the musculature absorb even more of

the load then may be required of conventional weight lifters belts. Thus, in view of the state of the art, there is definitely a present need for a device which can increase intra-abdominal pressure and promote proper posture while reducing risk of injury or fatigue.

Summary of the Invention

We believe that greater intra-abdominal pressure increases may be induced with less risk of injury than provided by the above devices. We further believe that proper lifting posture may be promoted without the drawbacks encountered by contact with abdominal bony prominences. In its broadest sense, the present invention accomplishes these desirable ends by the provision of an accessory for a conventional weight lifters belt or the like by which to provide a rigid bearing surface for a substantial portion of the abdomen during lifting. Specifically, we provide a rigid pad sized to fit between a person's abdominal bony landmarks and having a generally flat surface to mate with and overlie a substantial portion of the abdomen such that the belt or similar structure sandwiches the pad between the belt and the fleshy portion of the abdomen. Preferably, the pad is mounted to a conventional weight lifters belt.

In contrast to a weight lifter's belt and the CompVest device, the pad of the present invention

is inflexible and, thus, will not tend to warp or twist or otherwise deform when the abdomen bears against it during lifting. Hence, the rigid pad provides for uniform compression over the abdomen when the belt is tightened. Further, the pad provides a stiff surface against which the abdomen bears during lifting thereby urging the torso to maintain a generally linear orientation which cannot readily bend or flex about the longitudinal axis of the rigid pad such as is otherwise possible with a conventional weight lifters belt for example. Thus, rather than rely upon contraction of the trunk musculature to increase IAP as the person attempts to lift a load, the abdomen may bear firmly against the surface of the rigid pad to increase IAP, thereby relieving the spine and musculature of part of the load. In particular, the pad of the present invention is believed to provide a substitute "wall" to induce an increase in IAP with less musculature tension or effort in the torso than previously required. The increased IAP with less trunk musculature contraction is believed to advantageously reduce stress or strain on the lumbar/sacral area thereby reducing risk of lower back pain or injury while also limiting the risk of fatigue or injury to the musculature.

In a preferred embodiment, the pad provides a substantially flat surface which extends over a

substantial fleshy portion of the abdomen and between the bony prominences about the abdomen such that as the wearer of the pad bends to lift a load, the bony prominences move into or toward the edge of the pad. To avoid discomfort, the surface of the pad flares away from the body at the edges or corners adjacent the bony prominences. Thus, the surface of the pad preferably extends over most of the abdomen between the ribs and pubis with the angled corners extending from the lateral edges of the pad so as to lie outwardly of and angled away from the abdominal bony prominences. In this way, the abdomen may bear against the pad without the pad also undesirably contacting abdominal bony prominences. In a preferred embodiment where the pad is rectangular in shape, notches or gaps are cut into the pad between pairs of the angled corners extending from the corners to define strap slots along the sides of the pad through which the strap of the belt may be snugly received to thereby mount the pad to the belt.

Experimental studies with a rigid pad according to the principles of the present invention show it to be effective in enhancing force production of the torso of the humans tested and, thus, suggests that lower back pain and/or injury can be reduced to a level and extent not previously thought possible or achieved.

These and other objects and advantages of the invention shall be made apparent from the accompanying drawings and the description thereof.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate a preferred embodiment of the invention and, together with a general description of the invention given above, and the detailed description of a preferred embodiment given below, serve to explain the principles of the present invention.

Fig. 1 is a perspective view from the front of a preferred embodiment of an abdominal pad constructed in accordance with the principles of the present invention;

Fig. 2 is a side elevational view of the abdominal pad of Fig. 1;

Fig. 3 is a partially cutout, rear elevational view of the pad of Fig. 1;

Fig. 4 is a perspective view of the abdominal pad of Fig. 1 in combination with a weight lifters belt to provide a lumbar/sacral support in accordance with the principles of the present invention;

Fig. 5 is a side view of the support of Fig. 4 properly secured about the waist of a human standing erect;

Fig. 6 is a front view of the support of Fig. 4 properly secured about the waist of a human standing erect; and

Fig. 7 is a view like Fig. 5 showing the human abdomen bearing against the pad of Fig. 1 in response to lifting stresses as contemplated by the present invention.

Detailed Description of the Drawings

With reference to Figs. 1-3, there is shown a rigid abdominal pad 10 constructed in accordance with the principles of the present invention. Pad 10 includes a rigid plate 12 having an outer bearing surface 14. Conforming to plate 12 upon bearing surface 14 may be an outer cushion 16. Plate 12 may be formed from a ¼ inch thick stiff plastic such as polypropylene. Cushion 16, which overlies bearing surface 14 and conforms to the shape of plate 12, provides a comfort surface for the user and may be formed from a 3/16 inch thick slab of aliplast secured to plate 12 such as by glue (not shown).

Bearing surface 14 is defined between longitudinal superior or upper edge 18 and inferior or lower edge 20 and lateral left and right edges 22, 24, respectively. The dimension of pad 10 between those edges is selected for proper anatomical fit and comfort against the human abdomen (see Figs. 5 and 6) so as to overlie a substantial portion of the abdomen

between the pubic symphysis and xiphoid or lowest part of the ribs on the one hand and the iliac prominences or crests on the other hand, i.e., between the bony prominences about the abdomen. Between these bony landmarks of the abdomen is an area of the abdomen that does not closely overlie any bone structure. This area is referred to herein as the fleshy portion of the abdomen. Preferably pad 10 is sized to overlie a substantial portion of this fleshy portion. The following is a table of preferred dimensions, in inches, of pad 10 for various size men and women wherein vertical is between edges 18 and 20 and width is between edges 22 and 24:

MEN

	SMALL	MEDIUM	LARGE	X-LARGE
Vertical	4 3/4	6 1/4	7	7 1/4
Width	5	6 1/2	7 1/4	7 3/8

WOMEN

	SMALL	MEDIUM	LARGE	X-LARGE
Vertical	4 1/2	6	6 1/2	6 3/4
Width	5 1/2	7	7 1/4	7 3/8

Thus, pad 10 generally is between four to seven inches measured vertically and five to eight inches measured horizontally.

To avoid impinging the bony prominences or snagging any skin or fat about the abdomen while using pad 10, pad 10 is provided with transition zones at

the periphery thereof. These transition zones are preferably accomplished by angling the upper and lower corners 26, 28 of pad 10 away from bearing surface 14. Due to the size of pad 10, corners 26, 28 would, if planar to surface 14, undesirably impinge against abdominal bony prominences during lifting. However, corners 26, 28 are sufficiently angled so as to extend over and away from such bony prominences so that as the user bends, undesirable contact with bony prominences 84 is avoided. In particular, superior corners 26 flare away from the subcostal angles of the human ribs 94 so as not to impinge on the ribs during lifting. Similarly, inferior corners 28 flare away from the pubis to avoid impinging the pelvic 96 or hip bones during lifting. Further, the entire inferior edge 20 preferably flares away from surface 14 to avoid impinging against the pelvis and, in particular, the iliac prominences or crests during lifting. Upper edge 18 may also have a slight flare to avoid impinging against the upper abdomen during lifting.

In a preferred embodiment, C-shaped notches 32 are formed in pad 10 between each pair of corners 26, 28 to receive a strap portion of a belt as will be discussed. C-shaped notches 32 are defined between generally parallel, upper and lower edges 34 at corners 26, 28 and perpendicular bight edges 36 therebetween. Bight edges 36 are preferably bevelled

away from bearing surface 14 as at 38 to allow the belt strap portion to better conform to pad 10.

Pad 10 is preferably mounted to a retaining structure such as a conventional weight lifters belt 40 as shown in Fig. 4 to form a lumbar/sacral support 42. Belt 40 includes an elongated leather strap 44 having an enlarged or widened portion 46 centrally located between outer ends 48, 50 of strap 44. To mount one end 48 of strap 44 to pad 10, end 48 is fitted into notches 32 on pad 10 such as by being pressed into place therein between respective edges 34.

Although not necessary, belt 40 may be held to pad 10 with a clip or other retaining structure (not shown) secured to front wall or non-bearing surface 60 of plate 12. As will be appreciated, such retaining structure may take any one of a number of forms such as a resilient clip, strap or loop and pile velcro fastener, to name but a few.

To secure pad 10 against the abdomen, belt 40 may include any conventional means for fastening one end 48 to the other end 50. In the illustrative example, belt 40 is provided with a buckle 70 mounted to strap end 48 by a leather keeper 72 and a plurality of holes 74 formed in end 50 to receive teeth 76 of buckle 70 to form a conventional belt fastener. As is well understood, ends 48, 50 may alternatively be

joined together by velcro fasteners with loop and keeper (not shown) or any other fastener which will permit belt 40 to be securely fastened about the waist as will now be described.

Pad 10 is positioned centrally over the fleshy portion 80 of abdomen 82 and between abdominal bony prominences 84 of a human subject 86 such that bearing surface 14 of pad 10 faces the subject's abdomen 82 and corners 26, 28 are adjacent bony prominences 84. Belt 40 is placed about the human's waist 90 such that widened portion 46 of belt 40 overlies lower spine portion 92 as seen in Fig. 5 and strap ends 48, 50 overlie pad 10 to hold pad 10 over fleshy portion 80 of abdomen 82 and between the abdominal bony prominences 84 such as the xiphoid or ribs 94 and pelvis 96 as seen in Fig. 6. Although intimate contact between surface 14 and abdomen portion 80 is acceptable, cushion 16 is provided therebetween for comfort. Further, a shirt (not shown), for example, could be worn between pad 10 and abdomen 82 although cushion 16 is sufficient to provide a comfortable surface against abdomen 82. Once properly positioned, belt ends 48 and 50 are brought together and tightened in conventional manner such that abdomen portion 80 is compressed by pad 10 from its nominal outwardly-bowed orientation as shown in phantom line in Fig. 5 to a substantially planar

and vertical orientation as shown in solid line in that view. Belt 40 is properly tightened when slight bending of subject 86 causes abdomen portion 80 to bear against pad 10 such that abdomen 82 is restrained from bending or flexing about longitudinal axis 30 of pad 10.

As subject 86 tries to bend at the waist as shown in Fig. 7, abdomen portion 80 will bear against surface 14 of pad 10. This bearing contact will tend to prevent the abdomen from bending thus encouraging proper lifting posture by urging trunk 98 into a substantially linear orientation between the chest 100 and hips 102. And as the trunk 98 rotates between positions shown in Figs. 5 and 7, the flaring of corners 26, 28 prevent undesirable contact with bony prominences and further avoids biting contact between pad 10 and any flesh or fat about the abdomen. Similarly, flaring of inferior edge 20 reduces biting contact between pad 10 and the pubic area of the human as might otherwise occur if edge 20 were not flared.

In use, as subject 86 bends over and tries to lift a load (not shown), abdomen portion 80 will bear against surface 14 of pad 10. Pad 10 is believed to provide a wall which substitutes for trunk musculature contraction to thereby increase IAP without undue musculature activity in the abdomen. The result

is an increase in lifting capacity which is believed to be attained with reduced risk of pain or injury to the spine by better spreading stress from the spine to the abdomen without injuring or fatigue of the musculature. That is, the present invention is believed to result in elevating IAP without placing an undue load or stress on the abdominal wall muscles. Thus, instead of relying upon the musculature to contain and compress the abdomen to transfer force from the spine, the rigid pad 10 is provided for this purpose.

The particular shape of pad 10 is of further advantage in providing a maximally stiff and large plate 12 to compress as much of abdomen 82 as possible while avoiding the discomfort, potential injury and limitation which may result from contact with abdominal bony prominences.

Examples

Ten well-conditioned males between the ages of 21 and 35 undergo isokinetic back testing under three conditions. Each of the subjects is tested without any support (control), with a CompVest device, and with a support comprised of a rectangular rigid pad held to the abdomen according to the principles of the invention (experimental support).

Reduction in trunk flexion forces is believed to be indicative of increased IAP. The isokinetic back tests demonstrate trunk flexion forces at various speeds of isokinetic resistance with the pad as compared to the CompVest device and no device. The results are statistically highly significant for the various measures of average muscle torque, work and power for trunk flexion at 30° per second as shown in Table I:

TABLE I

Measure	CompVest	Experimental Support	Control
Torque/ Newton Meters	213.43	200.95	222.92
Work/ Newton Meters	262.38	246.24	272.42
Power/Watts	90.30	84.50	94.00

Measures at higher speeds of isokinetic resistance (60°/sec., 90°/sec. and 120°/sec.) are also found to be statistically significant with the experimental support. Trunk rotation of muscle torque is also statistically significant. Also, grand means for peak lifting force (Table II) and lifting power (Table III) are found to be higher when subjects perform the lifting task with the pad than without. The increase in these measures are consistent with increased trunk forces obtained during trunk extension trials when subjects wear the pad as compared to the control:

TABLE II

GRAND MEANS AND STANDARD DEVIATIONS FOR PEAK LIFTING FORCES (Values Expressed in Newtons)

Speed of Resistance	Mean/SD CompVest	Mean/SD Experimental Support	Mean/SD Control
30 inches/sec	1373.71 (318.70)	1420.44 (290.71)	1325.21 (322.35)

TABLE III

GRAND MEANS AND STANDARD DEVIATIONS FOR LIFTING POWER (Values Expressed in Watts)

Speed of Resistance	Mean/SD CompVest	Mean/SD Experimental Support	Mean/SD Control
30 inches/sec	732.60 (211.32)	766.60 (177.16)	712.20 (171.01)

The results suggest that the capacity to increase lifting forces are enhanced with the present invention. The results also suggest that the present invention provides increases in IAP with less stress on the musculature than provided by the prior art. The results further suggest that less musculature activity is required to lift the same load with a pad according to the invention than with the CompVest device of the prior art or with no support. This is believed to reduce stress on the back or spine and, thus, reduce risk of injury thereto. It is also believed that if the musculature were to become more

involved, the present invention would result in an even greater IAP than possible with prior art devices, thereby further reducing stress on the back.

Further analysis and detail of such studies may be found in the thesis prepared by Michael L. Woodhouse, one of the inventors herein, entitled "The Effects of Various Lumbar/Sacral Back Support Systems Upon Human Peak Muscular Force, Total Work, and Average Power" submitted to the faculty of Old Dominion University. The thesis is incorporated herein by reference and a copy is submitted with this application for patent.

Additional advantages and modifications will readily appear to those skilled in the art. The present invention in its broader aspects is therefore not limited to the preferred embodiment and illustrated example shown and described. Accordingly, departures may be made from such details and/or departing from the spirit or scope of the present invention.

Having described the present invention, what is claimed is:

1. An abdominal pad for a lumbar/sacral support, comprising:

a rigid plate having a generally flat bearing surface sized to overlie a substantial fleshy portion of a human abdomen between abdominal bony prominences and provide an effective bearing surface for the human abdomen during lifting.

2. The abdominal pad of claim 1, said plate sized to completely overlie a substantial portion of the human abdomen between the abdominal bony prominences.

3. The abdominal pad of claim 1, said plate having a vertical dimension and a horizontal dimension, said vertical dimension being between approximately five to eight inches and said horizontal dimension being between approximately four to seven inches.

4. The abdominal pad of claim 1 further comprising:

a cushion overlying said bearing surface and conforming to said plate.

5. The abdominal pad of claim 1, said plate having a periphery, the pad further comprising:

angled corners about said plate periphery at locations adjacent bony abdominal prominences and extending away from said bearing surface of said plate.

6. The abdominal pad of claim 5, said plate being substantially rectangular, said angled corners being at respective corners of said rectangular plate.

7. The abdominal pad of claim 5, at least one pair of said angled corners cooperating to define a gap along an edge of said plate sized to snugly receive therein a strap of a belt-like support structure.

8. The abdominal pad of claim 1 further comprising:

mounting means for mounting said plate to a belt-like support structure.

9. The abdominal pad of claim 8, said mounting means including:

a slot defined adjacent an edge of said plate for receiving therein a portion of the belt-like support structure.

10. The abdominal pad of claim 9, said slot having a bight edge bevelled away from said bearing surface.

11. The abdominal pad of claim 8, said plate having a periphery, said mounting means including:

at least one pair of corners about said plate periphery at locations adjacent bony abdominal prominences and extending away from said bearing surface of said plate, said corners spaced to define a slot along an edge of said plate for receiving therein a portion of the belt-like support structure.

12. The abdominal pad of claim 11, said slot having a bight edge bevelled away from said bearing surface.

13. A lumbar/sacral support comprising:

a rigid plate having a generally flat bearing surface sized to overlie a substantial fleshy portion of a human abdomen between abdominal bony prominences and provide an effective bearing surface for the abdomen during lifting; and

retaining means for retaining said bearing surface against the abdomen such that the abdomen bears against said surface during lifting.

14. The lumbar/sacral support of claim 13, said plate sized to completely overlie a substantial portion of the human abdomen between the abdominal bony prominences.

15. The lumbar/sacral support of claim 13, said plate having a vertical dimension and a horizontal dimension, said vertical dimension being between approximately five to eight inches and said horizontal dimension being between approximately four to seven inches.

16. The lumbar/sacral support of claim 13 further comprising:

a cushion overlying said bearing surface and conforming to said plate.

17. The lumbar/sacral support of claim 13, said plate having a periphery, the pad further comprising:

angled corners about said plate periphery at locations adjacent bony abdominal prominences and extending away from said bearing surface of said plate.

18. The lumbar/sacral support of claim 13 wherein said retaining means includes a belt-like structure.

19. The lumbar/sacral support of claim 18 wherein said belt-like structure is a weight lifters belt.

20. The lumbar/sacral support of claim 18, said retaining means further including a slot defined along an edge of said plate for receiving therein a portion of said belt-like structure.

21. The lumbar/sacral support of claim 20, said slot having a bight edge bevelled away from said bearing surface.

22. The lumbar/sacral support of claim 18, said plate having a periphery, said mounting means including:

at least one pair of corners about said plate periphery at locations adjacent bony abdominal prominences and extending away from said bearing surface of said plate, said corners spaced to define a slot along an edge of said plate for receiving therein a portion of said belt-like structure.

23. The lumbar/sacral support of claim 22, said slot having a bight edge bevelled away from said bearing surface.

24. An abdominal pad for use with a lumbar/-sacral support for reducing stress and strain on a human's lumbar/sacral area when the human is lifting an object, said abdominal pad comprising:

a rigid plate having longitudinal superior and inferior zones and a longitudinal axis, said rigid plate further having a bearing surface sized to overlie a substantial fleshy portion of the human's abdomen between abdominal bony prominences and to provide an effective bearing surface for the human's abdomen when the human lifts an object, whereby when the abdominal pad is retained adjacent the human's abdomen and the human lifts the object, the abdominal pad elevates the intra-abdominal pressure with less musculature tension and flexion in the human's torso than previously required when lifting the same object without the abdominal pad, by providing more uniform compression over the human's abdomen, and maintains the human's torso in a generally linear orientation which cannot readily bend or flex about the longitudinal axis of said rigid plate, so that stress and strain on the human's lumbar/sacral area is reduced.

25. The abdominal pad of claim 24 further comprising:

means extending along the superior and inferior zones of said rigid plate for minimizing contact between the abdominal pad and abdominal bony prominences when the human lifts an object.

26. A method of reducing risk of back or spine injury to a human from lifting comprising:

compressing a generally flat bearing surface of a rigid plate against the human's abdomen, said plate sized (i) small enough to fit against the fleshy portion of the abdomen without contacting abdominal bony prominences and (ii) large enough to effectively permit the human abdomen to bear thereagainst without bending when the human lifts a load.

27. The method of claim 26 further comprising:

sandwiching the plate between the abdomen and a belt encircling the human's waist whereby to hold the plate against the abdomen.

28. The method of claim 27 further comprising:

providing slots in opposite edges of the plate; and

receiving portions of the belt in the slots.

29. The method of claim 26 further comprising flaring corners of the plate away from the bearing surface and over abdominal bony prominences to avoid undesirable contact therewith by the plate during lifting.

30. The method of claim 29 further comprising flaring an inferior edge of the plate away from the bearing surface to avoid biting contact with the pubis during lifting.

31. The method of claim 26 further comprising flaring an inferior edge of the plate away from the bearing surface to avoid biting contact with the pubis during lifting.

32. The method of claim 26 further comprising providing a cushion in overlying relationship to the bearing surface and conforming to the plate.

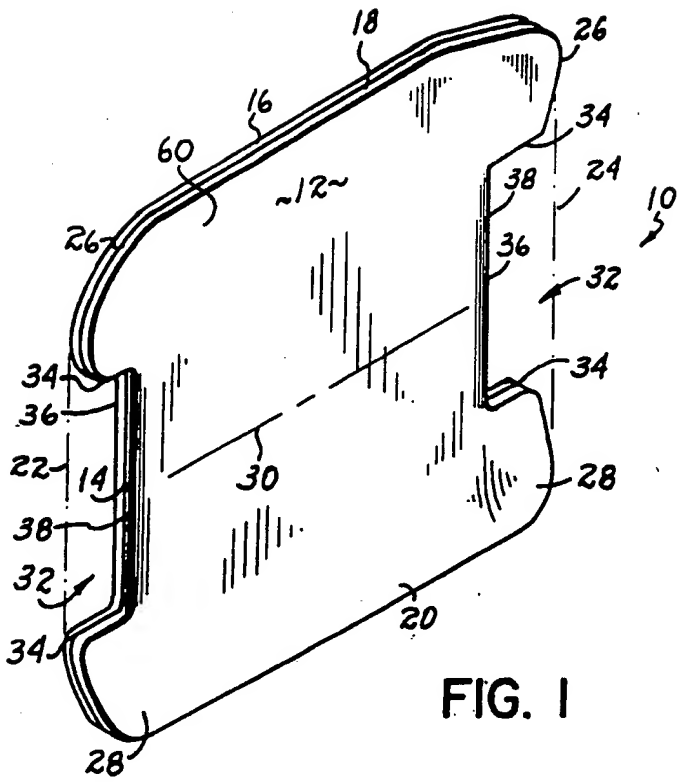

FIG. 1

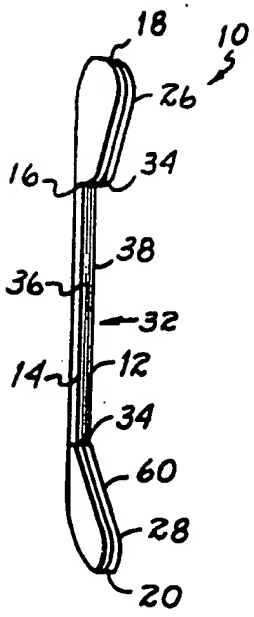

FIG. 2

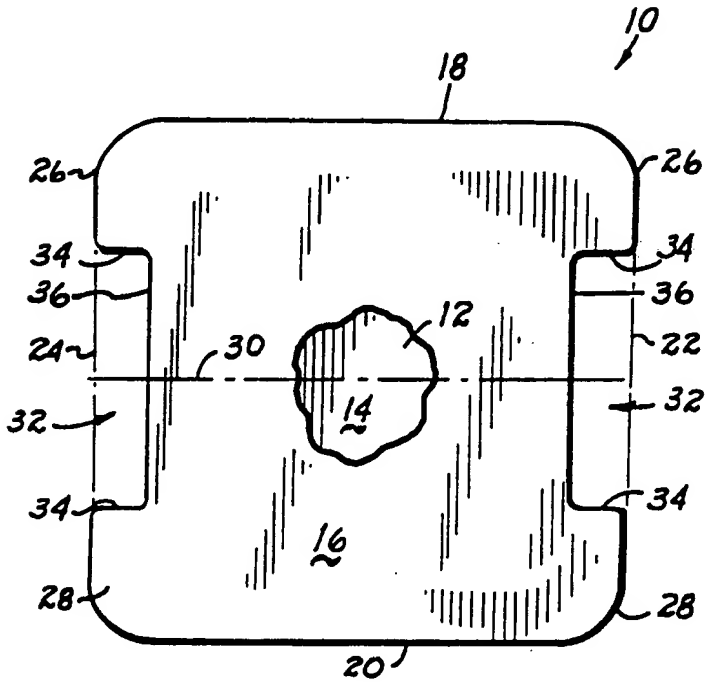

FIG. 3

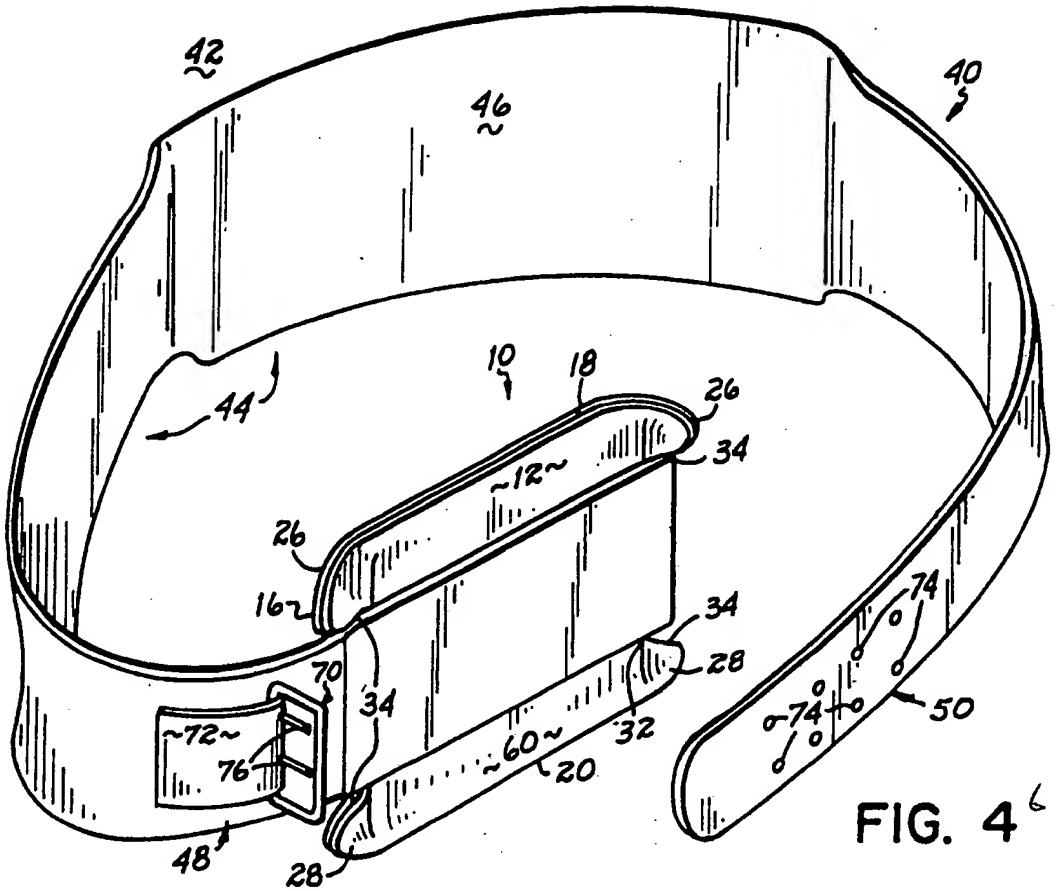
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FIG. 4

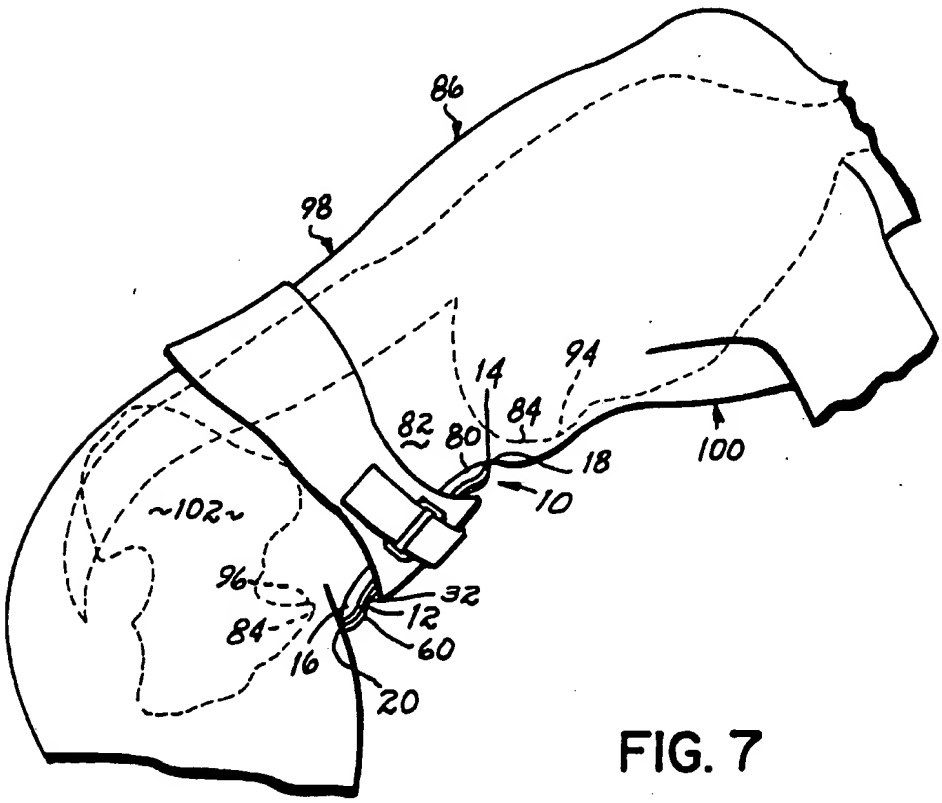
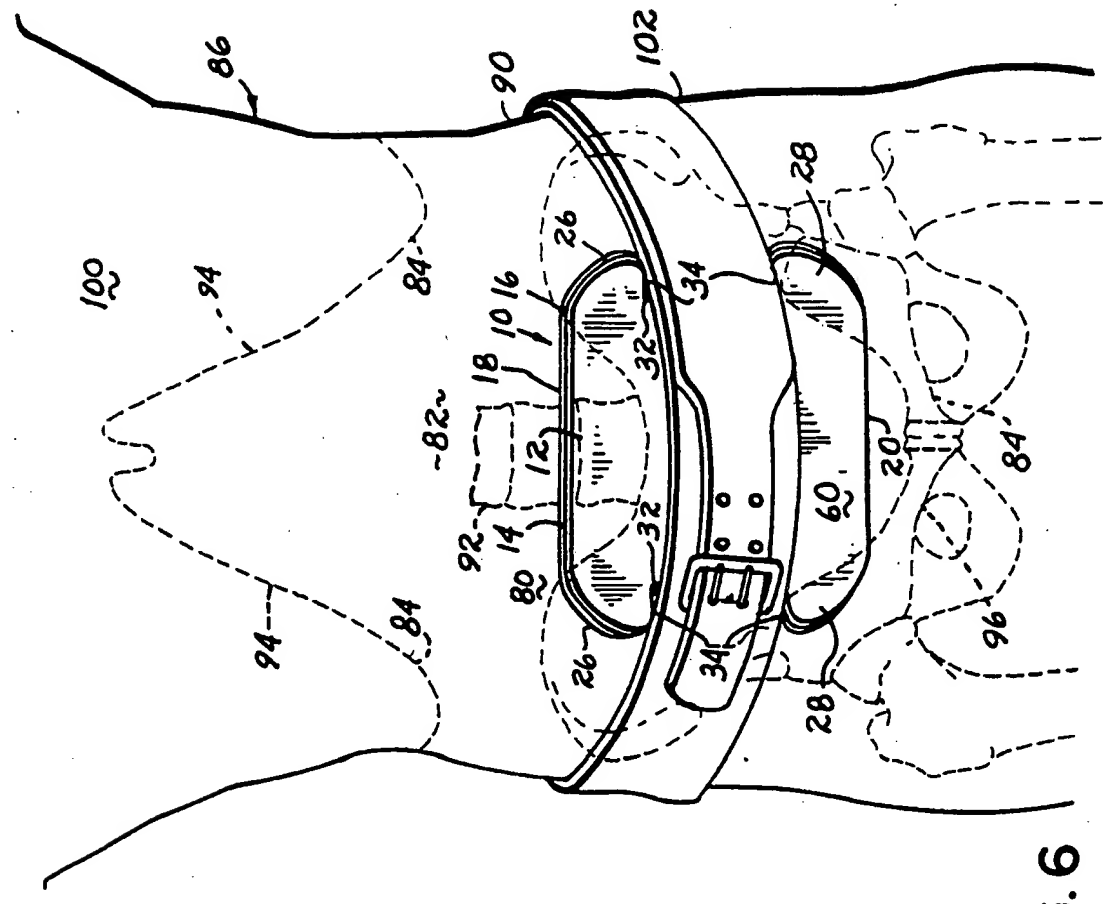

86
98
14
94
82
80
84
18
100
10
102
96
84
16
32
12
60
20

FIG. 7


86
90
102
28
26
34
32
18
10
16
100
94
84
82
12
14
92
80
60
20
84'
96
FIG. 6

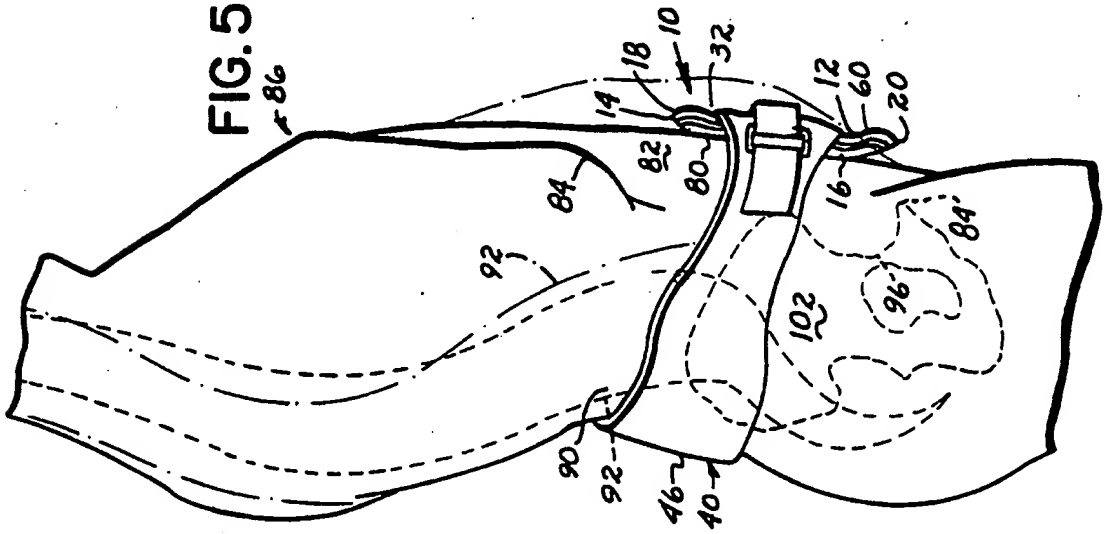


FIG. 5
86
18
10
32
12
60
20
14
82
80
84
16
92
84'
96
102
90
92
46
40

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 89/05103

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: A 61 F 5/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	A 61 F, A 63 B, A 41 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	DE, A, 3531573 (CHITRALLA) 26 March 1987, see abstract; column 4, line 54 - column 5, line 15	1-4,8,13-16, 18,19,24, 26,27,32
A	US, A, 2828737 (HALE) 1 April 1958	
A	US, A, 4545370 (WELSH) 8 October 1985 (cited in the application)	

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
14th March 1990	12 APR 1990
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	Mme N. KUIPER

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 8905103 SA 32704

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 06/04/90
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 3531573	26-03-87	None	
US-A- 2828737		None	
US-A- 4545370	08-10-85	None	

EPO FORM P0479

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82